SCIENCE:

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AN OLD VOLCANIC ERUPTION IN IOWA.

BY CHARLES R. KEYES, DES MOINES, IOWA.

IN the extreme northwestern corner of Iowa there is a small area of crystalline rocks commonly known under the name of the Sioux Quartzite or Sioux "Granite." These are the only strata in the State showing any decided traces of being changed through dynamic influences. Everywhere else within the limits of the province the rocks are so horizontal in their position, so undisturbed by mountain-making forces, and so unaltered in lithological characters, that it is generally taken for granted that all the strata in the State are sedimentary in origin and repose essentially as they were originally laid down in the waters of the great interior sea which once occupied the heart of the American continent.

The Sioux quarzite is a hard, vitreous mass with undulating bedding planes. Its geological age is regarded as much greater than that of any other formation in Iowa; not excepting even the old Cambrian sandstone of the northeastern portion of the State.

Although the area of the Sioux quartzite is quite extensive, no other crystalline rocks have been noted in the neighborhood until very recently. It is, then, of considerable interest to know that Professor G. E. Culver has lately discovered in the midst of the Sioux quartzite, of southeastern Dakota, in Minnehaha County, within three miles of the Iowa boundary, a large mass of trap, which extends for more than a mile along one of the tributaries of the Big Sioux River. A microscopical examination of these rocks shows it to be a well-pronounced, coarse-grained, olivine diabase, with such minerals as hornblende, black mica, and apatite present in addition to the feldspar, augite, and olivine.

The presence of this massive basic rock of unmistakable eruptive origin is very suggestive of the agencies that have been at work to some extent in changing the old sandstone. Further investigations will doubtless disclose other similar types of intrusive rocks in the Sioux quartzite in all three of the States already mentioned.

But the occurrence of this black trap rock, which has undoubtedly been cooled from a molten condition, is made even more interesting by other discoveries of still more recent date. During the past few years a number of deep wells or borings have been made at different places in northwestern Iowa. The depths reached are from 1200 to 2000 feet. Several of these borings are of special interest, inasmuch as they pass through all of the sedimentary rocks into the crystalline beds below, penetrating them in some cases to the extent of several hundred feet. A typical gray granite has been recognized in some instances; in others different types of eruptive rocks. One of the latest borings in this part of the State is the well at Hull, in Sioux County. At a very considerable depth a number of beds of flint-like rock were passed through. The different layers were separated by sand and gravel several feet in thickness, if the records are to be relied upon. Some of the flint-like fragments were sliced by Mr. S. W. Beyer of the Iowa Agricultural College, and upon microscopical examination proved to be what is known to geologists as quartz-porphyry — a truly igneous rock or lava, very acid in character, and essentially identical with granite, but cooling under somewhat different physical conditions.

The presence of the several sheets of quartz-porphyry, which are to be regarded as different lava flows, show conclusively that volcanic forces were very active in northwestern Iowa in ancient times. The position of the lava beds seems to indicate, as will be pointed out by Mr. Beyer in his discussion of the subject in the forthcoming Annual Report of the Iowa Geological Survey, that the flow of the molten rocks probably took place toward the close of the Carboniferous age, immediately after the coal of the Mississippi basin had been deposited.

Mr. Beyer puts forward, therefore, two explanations: —

1. That the flow took place during palæozoic time, perhaps in the Carboniferous, the lava being secularly poured out over an old sea-bottom.

2. That, as a whole, the different flows were contemporaneous and in point of time post-Carboniferous. In this case the intercalations are to be regarded as the results of the subterranean lava flows — the lava following along lines of least resistance and flowing between the strata.

It makes little difference which of these two views is accepted, for certain it is that here in northwestern Iowa there is every reason for believing that there were at one time active volcanic agencies at work not unlike those seen to-day in southern Europe, around the shores of the Mediterranean Sea.

THE PERMIAN IN PRINCE EDWARD ISLAND.

BY F. BAIN, NORTH RIVER, P. E. ISLAND.

THE study of the Permian in North America hitherto has not been satisfactory. The areas studied west of the Mississippi and in Virginia exhibit the lower part of the formation which in organic remains so closely resembles the Upper Carboniferous that a clear and satisfactory periodic distinction is not observable. In the Gulf of St. Lawrence, however, where a long-continued and regular subsidence marked the close of the palæozoic, we have a perfect series of the Permian strata, three thousand feet in depth, recording the gradations of life in this district between the close of the Carboniferous proper and the beginning of the Mesozoic.

The Island of Prince Edward, in the southern part of the Gulf of St. Lawrence, is composed of red sandstones and shales, mostly Permian, capped in the central district by a denuded fragment of the Trias. Where these Permian beds stretch across the Northumberland Strait and appear on the coast of New Brunswick, they are seen to repose unconformably on the Carboniferous. Here the distinction between the two formations is very apparent. The Carboniferous is a coarse, gray marsh deposit, bearing numerous remains of *Calamites* and *Cordaites* and a few *Lepidodendra*. The Permian consists of fine, red marine deposits, bearing as their characteristic organisms *Walchia*, *Tylodendra*, *Baiera*, *Pecopteris arborascens*, and *Calamites gigas*.

In the lower part of the Permian the flora has marked Carboniferous affinities, but there is always a clear and distinct difference. On St. Peter's Island, for example, there is a marsh deposit of the Permian. The gray and brown sandstones and gray bleached clays contain but few calamites, and these of small size, except the giant *C. gigas*. *Cordaites* is also inconspicuous, but remains of *Tylodendra* and *Walchia* are in great profusion, and *Annularia* frequent. At Gallas Point there is the same abundance of *Tylodendra* and *Walchia* with *Dadoxylon* and *Pecopteris*, and here, as in the other localities, *C. arenasceus* begins to take precedence of the older Carboniferous calamites. At Mimimigash is an extensive fern deposit in red clay shale. *Pecopteris arborascens* is abundant and is in magnificent development. Its great, heavy fronds are seen nine feet in length, and its features rich and well developed. *Alethopteris nervosa* is common, but *Sphenopteris*, *Neuropteris*, and *Cyclopteris* are sparsely represented. *Annularia* is abundant. *Cordaites* and *Calamites* hold a minor